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DESIGNATED/ELECTED OFFICE (DO/EO/US)**

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PCT/SE99/01799INTERNATIONAL FILING DATE  
October 7, 1999PRIORITY DATE CLAIMED  
October 7, 1998

## TITLE OF INVENTION

METHOD AND APPARATUS FOR PROVIDING ROUTING IN A CIRCUIT SWITCHED NETWORK

## APPLICANT(S) FOR DO/EO/US

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Applicant herewith submits to the United States Designated/ Elected Office (DO/EO/US) the following items under 35 U.S.C. 371:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
  - a. ☐ is transmitted herewith (required only if not transmitted by the international Bureau).
  - b. ☒ has been transmitted by the International Bureau.
  - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
  - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☐ have been transmitted by the International Bureaus.
  - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
  - d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 37(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). (unexecuted)
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

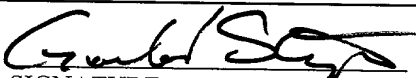
**Items 11. to 16. below concern document(s) or information included:**

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☐ A FIRST preliminary amendment.  
☐ A SECOND or SUBSEQUENT preliminary amendment.
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15. ☐ A change of power of attorney and/or address letter.
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17. ☒ The U.S. National Fee (35 U.S.C. 371(c)(1)) and other fees as follows:

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INDEPENDENT CLAIMS	2 - 3	0	X \$ 80.00	0.00
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$ 270.00	\$ 270.00
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<input type="checkbox"/> International preliminary examination fee paid to USPTO (37 CFR 1.482) ..... \$ 690				
<input type="checkbox"/> No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) ..... \$ 710				
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18. ☐ Other instructions  
n/a19. ☒ All correspondence for this application should be mailed to  
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NEW YORK, NEW YORK 10036-271120. ☒ All telephone inquiries should be made to (212) 790-2803Garland T. Stephens  
NAME  
SIGNATURE

37,242

REGISTRATION NUMBER

3/30/01  
DATE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: ☒ Application of: Lindgren et al.  
☐ Patent of:

☒ Application No.: TBA  
☐ Patent No.:

Group Art Unit: TBA

☒ Filed: March 30, 2001  
☐ Issued:

Examiner: TBA

For: METHOD AND APPARATUS FOR  
PROVIDING ROUTING IN A CIRCUIT SWITCHED  
NETWORK

Attorney Docket No.: 10806-004

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS  
[37 CFR 1.9(f) and 1.27(c)] - Small Business Concern

Assistant Commissioner for Patents  
Washington, D.C. 20231

Sir:

I hereby declare that I am

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the concern identified below:

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Address of organization P.O. Box 42093

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- ☐ the specification filed herewith

☒ application no. TBA filed March 30, 2001  
☐ patent no. issued

If the rights held by the above identified small business concern are not exclusive, each individual, concern or organization having rights to the invention is listed below and no rights to the invention are held by any person, other than the inventor, who could not qualify as an independent inventor under 37 CFR 1.9(c) if that person made the invention, or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d), or a nonprofit organization under 37 CFR 1.9(e).

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I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. [37 CFR 1.28 (b)]

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(37 CFR 1.27)

METHOD AND APPARATUS FOR PROVIDING ROUTING IN A CIRCUIT  
SWITCHED NETWORK

Technical Field of Invention

The present invention refers to a method and an apparatus for providing routing of asynchronous traffic in a circuit switched synchronous time division multiplexed network, more specifically in a DTM network.

Background of the invention

Today, new types of circuit-switched communication networks are being developed for the transfer of information using synchronous time division multiplexed bit-streams. Within this field, a new technology, referred DTM (Dynamic synchronous Transfer Mode), are currently being developed, primarily addressing the problem of providing quality of service to users of real-time, broadband applications.

The structure of a DTM network has been described in, e.g., "The DTM Gigabit Network", Christer Bohm, Per Lindgren, Lars Ramfelt, and Peter Sjödin, Journal of High Speed Networks, 3(2):109-126, 1994, and in "Multi-gigabit networking based on DTM", Lars Gauffin, Lars Håkansson, and Björn Pehrson, Computer networks and ISDN Systems, 24(2):119-139, April 1992.

The basic topology of a DTM network is preferably a bus with two unidirectional, multi-access, multi-channel optical fibers connecting a number of nodes. However, the topology may just as well be any other kind of structures e.g. a ring structure or a hub structure.

The bandwidth of each wavelength on the bus, i.e. each bitstream on each fiber, is divided into recurrent fixed length frames, which in turn are divided into fixed size time slots. The number of slots in a frame thus depends on the network's bit-rate. The time slots are divided into two groups, control slots and data slots. Control slots are typically used for transferring of

signaling messages between said nodes for the network's internal operation. The data slots are typically used for the transfer of data between end users connected to the different nodes.

5 Each node is arranged to dynamically establish, terminate, and modify DTM channels by dynamically allocating time slots thereto.

When DTM channels are used for transferring asynchronous traffic, such as TCP/IP packets, a mechanism for providing routing of said packets through the DTM network is needed. However, current available routing solutions are typically developed for use in other kinds of network architectures and therefore suggest mechanism that results in poor use of the advantageous aspects of a network of the DTM kind.

It is therefore an object of the invention to provide a routing solution in a network of the DTM kind, which make better use of the features of such a network.

## 20 Summary of the Invention

The above mentioned and other objects are achieved by the invention as defined in the accompanying claims.

Hence, according to the invention, a multi-channel multi-access bitstream carrying isochronous channels is accessed, said isochronous channel being used for the transfer of asynchronous traffic, and a data packet from a node connected to said bitstream is received in an isochronous channel thereof. Then, it is determined if said data packet is to be transmitted to another node connected to said bitstream using another channel of said isochronous channels. If so, said data packet is transmitted to said another node using said another channel of said isochronous channels on said bitstream.

The invention thus provides routing of data packets among isochronous channels of one and the same multi-channel multi-access bitstream. Typically, in conventional solutions, a router is provided to interconnect

two or more separate networks or, network sections, and to provide routing of data packets between such network sections. The routing solution according to the invention differs from this conventional approach in that routing is provided among the channels of a single multi-channel multi-access bitstream. Consequently, a routing mechanism according to the invention, providing routing among channels of a single bitstream, need not be provided at an exit point of the bitstream, i.e. at the point of inter-connection to another bitstream. Note, however, that this does not mean that a routing mechanism according to the invention is limited to routing with respect to channels of one single bitstream only, as one may use conventional routing from said bitstream to another bitstream as well without departing from the scope of the invention.

The routing mechanism according to the invention provides the network designer with a greater freedom of architecture when designing networks. An example thereof will be described below with reference to Fig. 5.

According to a preferred embodiment, channels of said bitstream that are not to be routed by said routing mechanism are not accessed by said routing mechanism. Instead, such channels are bypassed, typically at the interface of an apparatus providing said routing mechanism. Consequently, the traffic in said bypassed channels will be unattended and unaffected by said routing mechanism. Of course, this requires the provision of means for separating channels of said isochronous channels that are to be received and channels that are not to be received.

However, according to an embodiment of the invention, if a data packet is received in a channel which carries asynchronous traffic that is to be routed by the routing apparatus but however also extends beyond the routing apparatus, i.e. a mulicasted channel that isn't set to terminate at the routing apparatus, further propagation of said data packet to other nodes connected to said bitstream using the isochronous channel from which

said data packet was received is uninhibited. Consequently, as an example, a channel may be a multicast channel wherein a data packet will reach a set of receivers, but wherein said data packet will at the same time be routed  
5 to another channel of said bitstream, for example to reach another set of receivers.

As mentioned in the introduction, a preferred use of the invention is in a network operating according to a Dynamic synchronous Transfer Mode (DTM) protocol, i.e. a  
10 so called DTM network, said isochronous channels then being DTM channels in said DTM network.

For definition, as referred to herein, a "DTM network" is a circuit switched time division multiplexed network of the kind wherein information is transferred  
15 between nodes of the network on bitstreams. Each bitstream is divided into regularly recurrent, essentially fixed size frames, so called DTM frames, each comprising a number of fixed size time slots, said time slots being separated into control slots and data slots. Control  
20 slots are used for control signaling between nodes of the network, and data slots are used for the transfer of user data (sometimes often referred to as payload data).

Furthermore, in a DTM network, write access to the time slots of a DTM frame is distributed among nodes  
25 being attached to the bitstream carrying said DTM frame, each node typically having write access to a respective at least one control slot and a respective dynamically adjustable set of data slots within each recurrent frame. Moreover, having write access to a time slot position in  
30 a frame means having write access to said time slot position within each recurrent frame.

In a DTM network, a node will use the data slots it has write access to for establishing so called DTM channels by allocating one or more of said data slots to each  
35 respective DTM channel. Hence, as referred to herein, a DTM channel is defined by one or more time slots occupying the same time slot position within each DTM frame of

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the bitstream upon which said DTM channel is carried. However, if a DTM channel reaches, for example, over two bitstreams, the channel may of course be defined by a different set of time slot positions on the two bit-

5 streams. Also, a DTM channel may be either a control channel or a data channel, depending on whether control or data slots that is allocated to said channel. Furthermore, a DTM channel may be uni-, multi- or broadcast.

As the demand for network capacity changes, DTM

10 channels may be dynamically established, terminated, or modified, the latter by changing the number of time slots allocated to a DTM channel. Also, the distribution of write access to time slot among different nodes may be dynamically modified as different nodes develop different

15 needs for control signaling and data transfer.

According to another embodiment of the invention, a routing mechanism according of the above mentioned kind is performed in relation to a memory that provides temporary storing of data packets at memory locations thereof, said memory locations being temporarily allocated for

20 storing respective data packets. This memory is then accessed for storing/transmission of data packets irrespective of which channel a data packet is received upon/-transmitted into, and is thus used as a shared memory

25 shared by all channels. This will provide a comparatively simple design for managing data packets in relation to multi-channel routing according to the invention.

Further aspects and advantages of the invention will be more fully understood by those skilled in the art from

30 the accompanying claims and from the following detailed description of exemplifying embodiments thereof.

#### Brief Description of the Drawings

Exemplifying embodiments of the invention will now

35 be described with reference to the accompanying drawings, wherein:

Fig. 1 shows an example of the structure of a bitstream in a DTM network;

Fig. 2 illustrates transfer of asynchronous traffic in one of the isochronous channels carried by the  
5 bitstream shown in Fig. 1;

Fig. 3 shows an exemplifying embodiment of an apparatus according to the invention;

Fig. 4 shows another exemplifying embodiment of an apparatus according to the invention; and

10 Fig. 5 shows a network comprising the apparatus shown in Fig 4.

#### Detailed Description of an Exemplifying Embodiment

An example of the structure of a multi-channel  
15 multi-access bitstream B in a circuit switched time division multiplexed network operating according to a DTM protocol will now be described with reference to Fig. 1.

As shown in Fig. 1, the bitstream B is divided into recurrent, essentially fixed sized frames, wherein the  
20 start of each frame is defined by a frame synchronization time slot F and each frame ends with one or more guard band time slots G.

Each frame is further divided into a plurality of fixed sized, typically 64 bit, time slots. When using a  
25 nominal frame duration of 125  $\mu$ s, a time slot size of 64 bits, and a bit rate of 2Gbps, the total number of time slots within each frame will be approximately 3900.

The time slots are divided into control slots C1, C2, C3, and C4, and data slots D1, D2, D3, and D4. Write  
30 access to the control and data slots are distributed among the nodes connected to the bitstream. As an example, in Fig. 1, a node N1 (connected to the bitstream B) will have access to a control slot C1 and a set of data slots D1 within each frame of the bitstream, a node N2  
35 (also connected to the bitstream) will have access to a control slot C2 and a set of data slots D2 within each frame of the bitstream, and so on. The set of slots allo-

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cated to a node as control slot(s) and/or data slot(s) occupy the same slot position within each frame of the bitstream. Hence, in the example, the control slot C1 belonging to node N1 will occupy the second time slot within each frame of the bitstream.

During network operation, each node may increase or decrease its access to control and/or data slots, thereby re-distributing the access to control slots and/or data slots among the nodes. For example, a node having a low transfer capacity demand may give away its access to data slots to a node having a higher transfer capacity demand. Also, the slots allocated to a node need not be consecutive slots, but may reside anywhere within the frame.

In Fig. 1 at (c), it is furthermore assumed that node N2, having access to its control slot C2 and its range of data slots D2, has established four channels CH1, CH2, CH3, and CH4 on the bitstream. As shown, each channel is allocated a respective set of slots. In the example, the transfer capacity of channel CH1 is larger than the transfer capacity of channel 2, since the number of time slots allocated to channel CH1 is larger than the number of time slots allocated to channel CH2. The time slots allocated to a channel occupy the same time slot positions within each recurrent frame of the bitstream.

An example of the transfer of asynchronous traffic in one of the isochronous channels carried by the bitstream B shown in Fig. 1 will now be described with reference to Fig. 2. In Fig. 2, it is assumed that the channel CH3 shown in Fig. 1 is established to carry asynchronous traffic in the form of sequentially transmitted variable size data packets, which for example could be TCP/IP packets or Ethernet frames. As channel CH3 comprises seven time slots within each frame on bitstream B, the first seven time slots transmitted in the channel CH3, i.e. the first seven time slots in Fig. 2, will be transmitted in one frame, the next seven time slots will be transmitted in the next frame, and so on.

Fig. 2 shows three packets transmitted in channel CH3. Each packet is encapsulated according to a predefined encapsulation protocol. In Fig. 2, it is assumed that the encapsulation protocol defines that each packet shall  
5 be divided into 64 bit data blocks (the size of a time slot), that a start\_of\_packet slot S is to be added to the start of each packet, and that an end\_of\_packet slot E is to be added to the end of each packet, thereby forming encapsulated packets P1, P2, and P3. In case of  
10 gaps between packets, the bitstream is provided with so called idle slots, identifying said gaps as not providing valid data.

An embodiment of an apparatus according to the invention will now be described with reference to Fig. 3.  
15 In Fig. 3, the apparatus 110 comprises a port 111, which in turn comprises an incoming channel interface 113 and an outgoing channel interface 114 providing read and write access, respectively, to a bitstream B, which for example may be the bitstream B shown in Fig. 1. The in-  
20 coming and outgoing channel interface will provide for synchronization of the operation of the apparatus in relation to the frame and slot rate on the bitstream B.

The incoming channel interface and the outgoing channel interface are connected to an incoming channel  
25 manager 115 and an outgoing channel manager 116, respectively. The incoming channel manager 115 and the outgoing channel manager 116 are both connected to a routing processor 117, a shared memory 119, a buffer manager 120, and a control unit 121. The routing processor 117 is in  
30 turn connected to a routing memory 118.

In operation, the incoming channel interface 113 will receive (arrow 1) data packets from the channels monitored by said interface, such as the encapsulated TCP/IP packets on channel CH3 as shown in Fig. 2.

35 The incoming channel interface 113 will then forward, with preserved sequential order, each received data block forming said packet to the incoming channel manager

115 (arrow 2). Each block forwarded to the incoming channel manager 115 is accompanied by a channel identifier, designating the channel from which it was received.

Having received sufficiently many data blocks at the head end of a packet to be able to derive information designating the size of the packet, the incoming channel manager will send a request (arrow 3), containing the size of the packet, to the buffer manager 120. The request will thereby inform the buffer manager 120 that the incoming channel manager 115 needs to store a packet of the designated size in the shared memory 119.

The buffer manager 120 will then allocate an address space of the shared memory 119 to said packet. The buffer manager 120 will answer the request by returning (arrow 4) a start address corresponding to the start of said address space to the incoming channel manager 115.

Having received said start address from the buffer manager 120, the incoming channel manager will start writing the data blocks forming the associated packet into the shared memory 119 (arrow 5), starting at the start address received from the buffer manager 120 and incrementing the address one step for each data block written into the shared memory 119.

At the same time, the incoming channel manager 115 sends the start address received from the buffer manager 120, along with the IP address designated in the header of the packet, to the routing processor 117 (arrow 6).

Using the routing memory 118 (arrow 7), the routing processor will, based upon the destination address received from the incoming channel interface 115, determine whether or not the associated packet is to be transmitted from the outgoing channel interface 114 and, if so, which outgoing channel that is to be used when transmitting said packet.

Having determined an outgoing channel for the data packet, the routing processor 117 will transmit a signal to the outgoing channel manager 116 (arrow 8), containing

a channel identifier and the start address received from the incoming channel manager. The channel identifier identifies the outgoing channel to be used when transmitting the associated packet address, and the start address designates where to read the associated packet from in the shared memory 120.

Having received the outgoing channel identifier and the start address from the routing processor 117, the outgoing channel manager 116 will access the shared memory (arrow 9) and start reading (arrow 10) data blocks forming the associated packet from the shared memory 119, beginning at the start address received from the routing processor 117 and incrementing the address one step for each data block read from the shared memory 119.

At the same time, the outgoing channel manager 116 will continuously receive requests (arrow 11) for data blocks for respective outgoing channels from the outgoing channel interface 114, said request being sent from the outgoing channel interface at the rate as time slots allocated to the respective channel passes on the outgoing bitstream accessed via the outgoing channel interface 114.

As triggered by said requests for data blocks, when said requests relates to a channel identified by the a channel identifier received from the routing processor 117, the outgoing channel manager 116 will forward (arrow 12), with preserved sequential order, each data block of the associated data packet, as read from the shared memory 119 starting at the designated start address, to the outgoing channel interface 114. The outgoing channel interface 114 will then, in turn, forward (arrow 13) the received data blocks to the respective channels on the outgoing bitstream.

Having read the last data block of a packet from the shared memory 119, the outgoing channel manager 120 will return (arrow 14) the associated start address, which was received from the routing processor 117, to the buffer

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manager 120. This will inform the buffer manager that the processing of the packet stored at the address space associated with said start address is complete and that the buffer manager is now free to allocate said address space to a new data packet received via the incoming channel interface.

Furthermore, the control unit 121 will determine which channels that are to be received by the incoming channel interface 113, which will typically be those channels use for transmission of data packets that need routing by the routing processor 117. Channels that are not to be directed to the routing processor 117, as determined by the control unit 121, are bypassed at the incoming/outgoing channel interface 113, 114 and are consequently not processed by the routing processor.

Another embodiment of an apparatus according to the invention will now be described with reference to Fig. 4. In the apparatus shown in Fig. 4, the only difference compared to the embodiment shown in Fig. 3 is that, in Fig. 4, the incoming channel manager 115 is provided with a cache memory 122. The cache memory 122 contains a list of destination addresses for which no routing is needed by the routing processor 117, as previously determined by the routing processor. A received packet referring to an address among said list of destination addresses shall not be directed to the routing processor 117. The routing processor will continuously update the content of the cache memory 122.

Consequently, when receiving a packet, the incoming channel manager 115 will compare the destination address of the packet against the destination addresses contained in the cache memory 122. If a match is found, the packet will be discarded at the incoming channel manager and will hence not be directed to the routing processor 117, thereby decreasing the processing load on the routing processor 117.

Note, however, that if the channel from which said data packet was received does not terminate at the apparatus 110 but instead continues to one or more other downstream nodes, e.g. if the channel is a multicast or broadcast channel, the packet may be forwarded to downstream nodes in the same channel as it was received irrespective of whether or not it is discarded at the incoming channel manager. Whether or not this bypassing is done at the incoming/outgoing channel interfaces 113, 114 or at the incoming/outgoing channel managers 115, 116 will typically be determined by the control unit 121.

A network utilizing the invention will now be described with reference to Fig. 5. In Fig. 5, an multi-channel multi-access bitstream B, which for example may be the bitstream B shown in the previous figures, forms a closed loop link connecting a plurality of access nodes A using circuit switched time division multiplexing according to a DTM protocol. A switch node S connected to the link provides connectivity between said link and another link that also uses circuit switched time division multiplexing according to said DTM protocol. On the latter link, a router R provides access to a packet switched network, such as the Internet. Furthermore, an apparatus 110 according to the invention, e.g. the apparatus described with reference to Fig. 3 or Fig. 4, is connected to the bitstream B.

In Fig. 5, the node apparatus 110 will typically have established an isochronous channel to the router R via the switch S. When an end user attached to an access node A on the bitstream B wants to send a packet, it may establish a channel to the appropriate destination on its own decision, for example a channel to another access node on the bitstream B or a channel to the router R via the switch S. However, it may also use a channel to the node apparatus 110, which will then, having received the packet, see to that the packet is forwarded to the appro-



priate destination, for example via a channel to the router R.

According to an alternative embodiment, multicast channels are established from each node connected to the bitstream B to all other nodes connected to the bitstream B. If an end user attached to an access node A on the bitstream B wants to send a packet to any destination, it will then simply multicast the packet using said multicast channel. As the multicasted packet is read at the nodes receiving said multicast channel, if it turns out that the destination address of the packet refers to an end user connected to another access node on said bitstream, said another node will see to that the packet is forwarded to said end user. However, if it turns out that the destination address of the packet refers to an end user not connected to via an access node to said bitstream, the node apparatus 110 will see to that the packet is forwarded to the appropriate destination, for example via a point-to-point channel to the router R.

Even though the invention has been described above with reference to exemplifying embodiments thereof, these are not to be considered as limiting the scope of the invention. Consequently, as understood by those skilled in the art, different modifications, combinations and alterations may be made within the scope of the invention, which is defined by the accompanying claims.

CLAIMS

1. A method for providing routing of asynchronous traffic in a circuit switched synchronous time division multiplexed network, said method comprising the steps of:
- 5 receiving, in an isochronous channel of a multi-channel multi-access bitstream carrying isochronous channels, said isochronous channel being used for the transfer of asynchronous traffic, a data packet from a node connected to said bitstream;
- 10 determining if said data packet is to be transmitted to another node connected to said bitstream using another channel of said isochronous channels; and, if so,
- transmitting said data packet to said another node
- 15 using said another channel of said isochronous channels on said bitstream.
2. A method as claimed in claim 1, comprising the steps of determining which channels of said isochronous channels that are to be received and bypassing those channels that are not to be received.
- 20 3. A method as claimed in claim 1 or 2, comprising the step of discarding said data packet if said data packet is not to be transmitted to another node connected to said bitstream using another channel of said isochronous channels.
- 25 4. A method as claimed in claim 1, 2, or 3, wherein further propagation of said data packet to other nodes connected to said bitstream using the isochronous channel from which said data packet was received is uninhibited.
- 30 5. A method as claimed in claim 1, 2, 3, or 4, wherein said data packet, when transmitted within said channel, is encapsulated according to a predefined encapsulation protocol.
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6. A method as claimed in any one of the preceding claims, wherein said steps are performed at a node connected to said multi-channel multi-access bitstream.

5

7. A method as claimed in any one of the preceding claims, wherein said steps are performed at a node which provides routing of data packets only among channels carried by said multi-channel multi-access bitstream.

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8. A method as claimed in any one of the preceding claims, wherein said network is operating according to a Dynamic synchronous Transfer Mode (DTM) protocol.

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9. A method as claimed in any one of the preceding claims, wherein said receiving step comprises temporarily allocating a location of a shared memory for storing said data packet and temporarily storing said data packet at said location of said shared memory, and wherein said transmitting step comprises reading said data packet from said location of said shared memory.

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10. An apparatus (110) providing routing of asynchronous traffic in a circuit switched synchronous time division multiplexed network, comprising:

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an interface (111) providing access to a multi-channel multi-access bitstream carrying isochronous channels; and

routing means (117) for determining if a data packet received by said interface in an isochronous channel of said isochronous channels, said isochronous channel carrying asynchronous traffic, is to be transmitted using another one of said isochronous channels and, if so, directing said data packet thereto via said interface.

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11. An apparatus as claimed in claim 10, comprising means for determining which channels of said isochronous

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channels that are to be received by said interface and which channels that are to be bypassed at said interface.

12. An apparatus as claimed in claim 10 or 11,  
5 wherein said interface means comprises means (122) for determining if said data packet is not to be transmitted using another one of said isochronous channels and, if so, preventing said data packet from being processed by said routing means.

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13. An apparatus as claimed in claim 10, 11, or 12,  
wherein said interface is arranged to forward said data packet using the isochronous channel from which said data packet was received in addition to the decisions made by  
15 said determining means.

14. An apparatus as claimed in claim 10, 11, 12, or 13, wherein said data packet, when transmitted within said channel, is encapsulated according to a predefined  
20 encapsulation protocol.

15. An apparatus as claimed in any one of claims 10-14, wherein said routing means provides routing of data packets only among channels carried by said multi-channel  
25 multi-access bitstream.

16. An apparatus as claimed in any one of claims 10-15, wherein said network is operating according to a Dynamic synchronous Transfer Mode (DTM) protocol.

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17. An apparatus as claimed in any one of claims 10-16, further comprising a memory (119) for temporarily storing said data packet at a memory location thereof, said memory location being temporarily allocated for  
35 storing said data packet, wherein said interface is arranged to write said data packet into said allocated memory location when receiving said data packet and to

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read said data packet from said allocated memory location when transmitting said data packet.

18. An apparatus as claimed in claim 17, further  
5 comprising a storage manager (120) being arranged to temporarily allocate a memory location for storing said data packet and to provide said interface with information designating said memory location for storing said data packet.

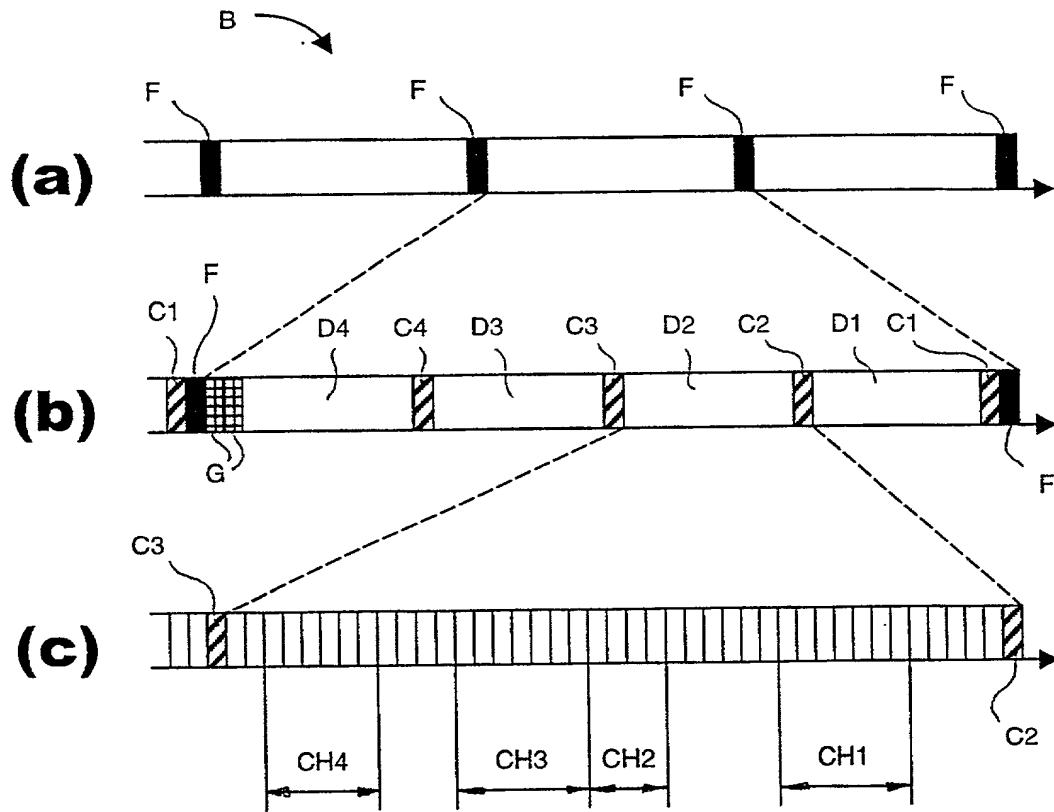
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19. An apparatus as claimed in claim 17 or 18,  
wherein said memory location is allocated for storing said data packet as a result of a request made by said interface when receiving said data packet.

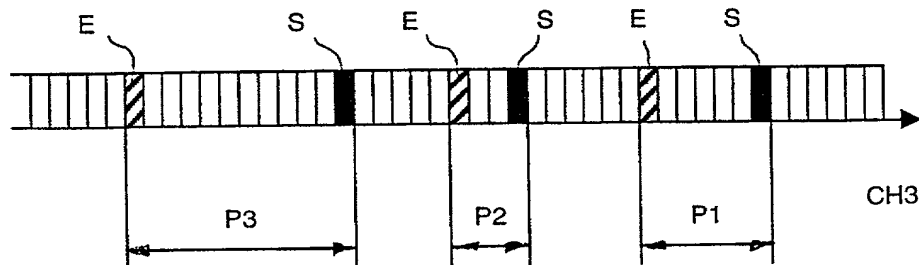
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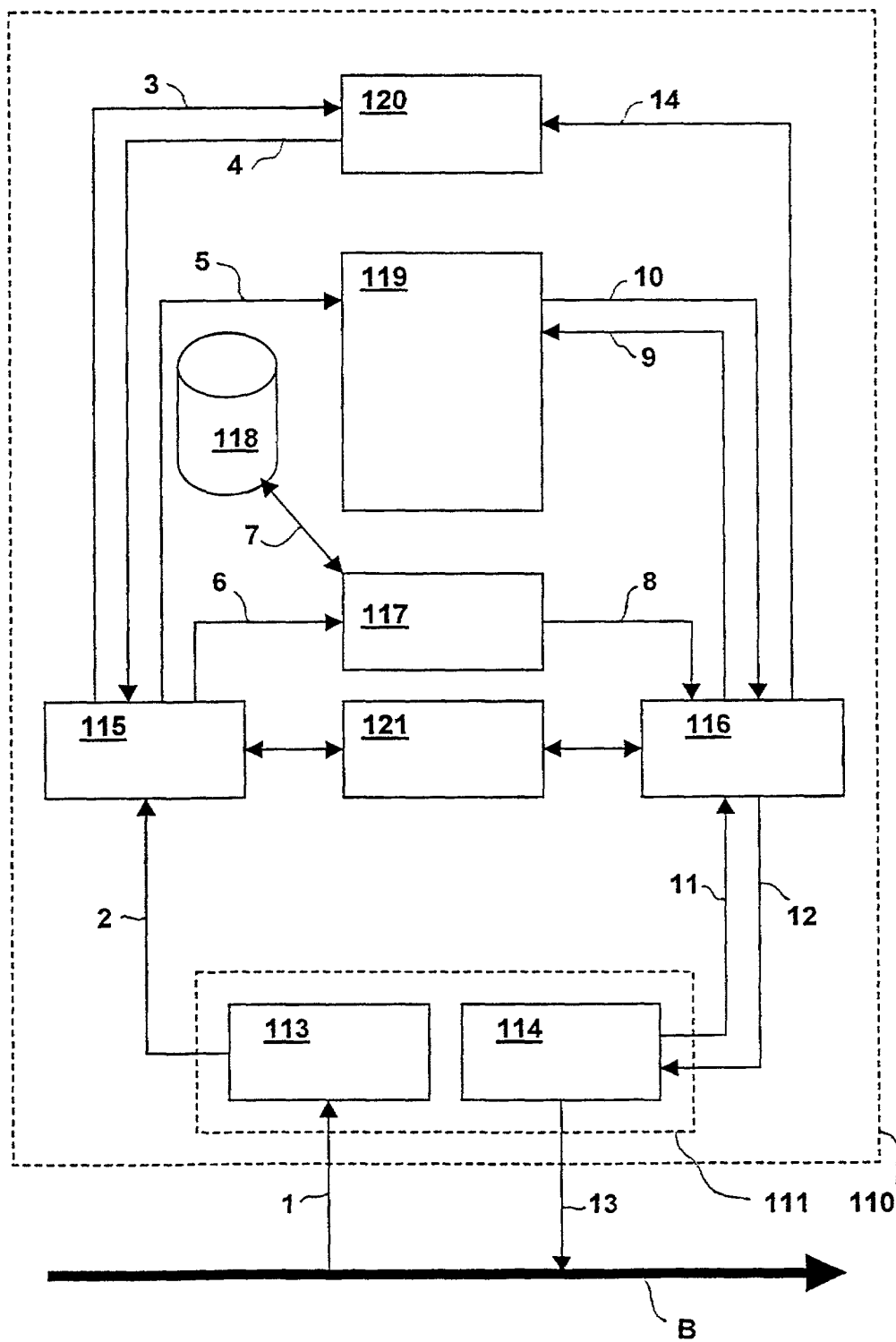


**Fig. 1**



**Fig. 2**

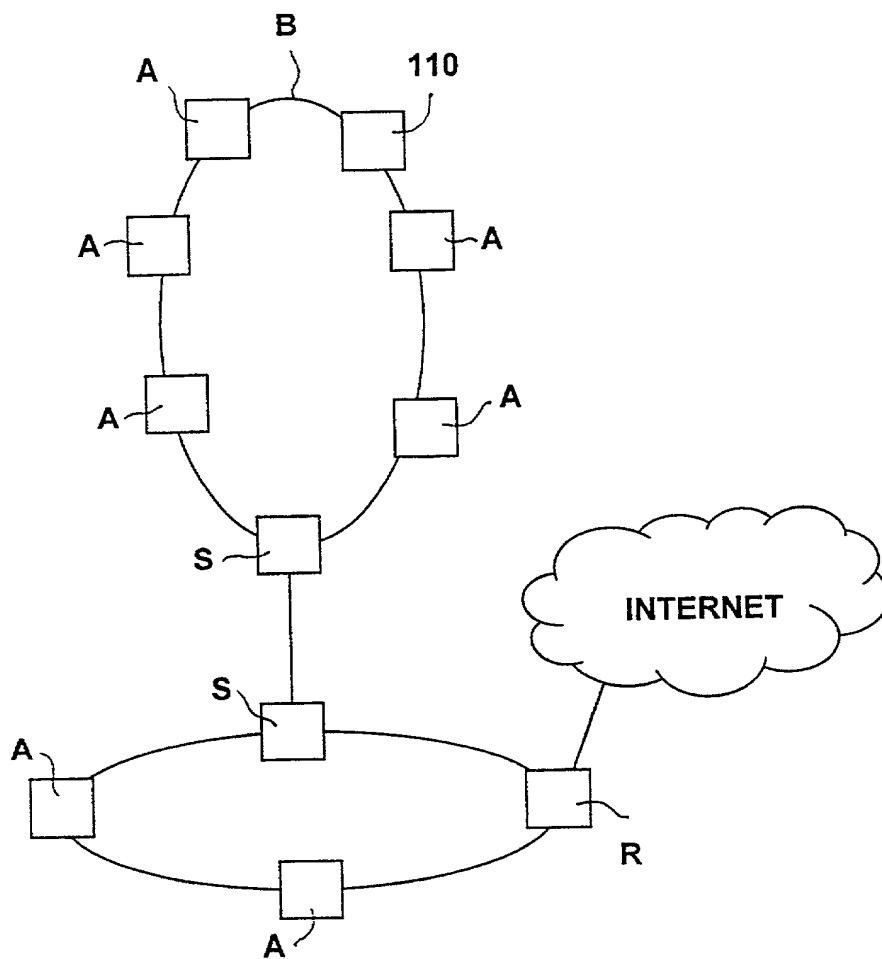
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**Fig. 3**



**Fig. 4**





**Fig. 5**



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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of: Per Lindgren, Christer Bohm, and Bengt Olsson

Application No.: TBA

Group Art Unit: TBA

Filed: March 30, 2001

Examiner: TBA

For: METHOD AND APPARATUS FOR  
PROVIDING ROUTING IN A CIRCUIT  
SWITCHED NETWORK

Attorney Docket No.: 10806-004

**POWER OF ATTORNEY BY ASSIGNEE  
AND EXCLUSION OF INVENTOR(S) UNDER 37 C.F.R. 3.71**

Assistant Commissioner for Patents  
Washington, D.C. 20231

Sir:

The undersigned assignee of the entire interest in the above-identified subject application hereby appoints: S. Leslie Misrock (Reg. No. 18872), Berj A. Terzian (Reg. No. 20060), David Weild, III (Reg. No. 21094), Jonathan A. Marshall (Reg. No. 24614), Barry D. Rein (Reg. No. 22411), Stanton T. Lawrence, III (Reg. No. 25736), Charles E. McKenney (Reg. No. 22795), Philip T. Shannon (Reg. No. 24278), Francis E. Morris (Reg. No. 24615), Charles E. Miller (Reg. No. 24576), Gidon D. Stern (Reg. No. 27469), John J. Lauter, Jr. (Reg. No. 27814), Brian M. Poissant (Reg. No. 28462), Brian D. Coggio (Reg. No. 27624), Rory J. Radding (Reg. No. 28749), Stephen J. Harbulak (Reg. No. 29166), Donald J. Goodell (Reg. No. 19766), James N. Palik (Reg. No. 25510), Thomas E. Friebe (Reg. No. 29258), Laura A. Coruzzi (Reg. No. 30742), Jennifer Gordon (Reg. No. 30753), Geraldine F. Baldwin (Reg. No. 31232), Victor N. Balancia (Reg. No. 31231), Samuel B. Abrams (Reg. No. 30605), Steven I. Wallach (Reg. No. 35402), Marcia H. Sundeen (Reg. No. 30893), Paul J. Zegger (Reg. No. 33821), Edmond R. Bannon (Reg. No. 32110), Bruce J. Barker (Reg. No. 33291), Adriane M. Antler (Reg. No. 32605), Thomas G. Rowan (Reg. No. 34419), James G. Markey (Reg. No. 31636), Thomas D. Kohler (Reg. No. 32797), Scott D. Stimpson (Reg. No. 33607), Gary S. Williams (Reg. No. 31066), Ann L. Gisolfi (Reg. No. 31956), Todd A.

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- [ ] An assignment of the entire interest in the above-identified subject application was recorded on \_\_\_\_\_ at reel/frame \_\_\_\_/\_\_\_\_.
- [ ] An assignment of the entire interest in the above-identified subject application is submitted herewith for recording.
- [x] A copy of an assignment of the entire interest in the above-identified subject application is submitted herewith. The assignment will be duly recorded.

Please direct all correspondence for this application to customer no. 20583.

ASSIGNEE:

NET INSIGHT AB

Signature:

*Bengt Olsson*

Typed Name:

BENGT OLSSON

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CEO

Address:

P.O. Box 42093

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Date:

MAY 5, 2001

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## ASSIGNMENT

WHEREAS, WE, Per Lindgren, Christer Bohm, and Bengt J. Olsson, ASSIGNORS, citizens of the Sweden, residing at Maria Prästgårdsgata 12, SE-118 52 Stockholm, Sweden; Skurusundsvägen 40, SE-131 46 Nacka, Sweden; and Rådursvägen 303, SE-147 34 Tumba, Sweden, respectively, are the inventors of the invention in METHOD AND APPARATUS FOR PROVIDING ROUTING IN A CIRCUIT SWITCHED NETWORK for which we have executed an application for a Patent of the United States

☐ which is executed on ☐ even date herewith or ☐ \_\_\_\_\_

☒ which is identified by Pennie & Edmonds LLP docket no. 10806-004

☒ which was filed on March 30, 2001, Application No. TBA

and WHEREAS, Net Insight AB, ASSIGNEE, a corporation organized under the laws of Sweden, is desirous of obtaining our entire right, title and interest in, to and under the said invention and the said application:

NOW, THEREFORE, in consideration of the sum of One Dollar (\$1.00) to us in hand paid, and other good and valuable consideration, the receipt of which is hereby acknowledged, we, the said ASSIGNORS, have sold, assigned, transferred and set over, and by these presents do hereby sell, assign, transfer and set over, unto the said ASSIGNEE, its successors, legal representatives and assigns, our entire right, title and interest in, to and under the said invention, and the said United States application and all divisions, renewals and continuations thereof, and all Patents of the United States which may be granted thereon and all reissues and extensions thereof; and all applications for industrial property protection, including, without limitation, all applications for patents, utility models, and designs which may hereafter be filed for said invention in any country or countries foreign to the United States, together with the right to file such applications and the right to claim for the same the priority rights derived from said United States application under the Patent Laws of the United States, the International Convention for the Protection of Industrial Property, or any other international agreement or the domestic laws of the country in which any such application is filed, as may be applicable; and all forms of industrial property protection, including, without limitation, patents, utility models, inventors' certificates and designs which may be granted for said invention in any country or countries foreign to the United States and all extensions, renewals and reissues thereof;

AND WE HEREBY authorize and request the Commissioner of Patents and Trademarks of the United States, and any Official of any country or countries foreign to the United States, whose duty it is to issue patents or other evidence or forms of industrial property protection on applications as aforesaid, to issue the same to the said ASSIGNEE, its successors, legal representatives and assigns, in accordance with the terms of this instrument.

AND WE HEREBY covenant and agree that we have full right to convey the entire interest herein assigned, and that we have not executed, and will not execute, any agreement in conflict herewith.

AND WE HEREBY further covenant and agree that we will communicate to the said ASSIGNEE, its successors, legal representatives and assigns, any facts known to us respecting said invention, and testify in any legal proceeding, sign all lawful papers, execute all divisional, continuing, reissue and foreign applications, make all rightful oaths, and generally do everything possible to aid the said ASSIGNEE, its successors, legal representatives and assigns, to obtain and enforce proper protection for said invention in all countries.

IN TESTIMONY WHEREOF, We hereunto set our hands and seals the day and year set opposite our respective signatures.

Date May 3, 2001 Per Lindgren (Signature) L.S.

On this 3 day of May, 2001, before me, a witness, personally appeared Per Lindgren, to me known and known to me to be the person of that name, who signed the foregoing instrument, and he acknowledged the same to be his free act and deed.

[Signature] Witness

Date 2/5, 2001 Christer Bohm (Signature) L.S.

On this 2 day of May, 2001, before me, a witness, personally appeared Christer Bohm, to me known and known to me to be the person of that name, who signed the foregoing instrument, and he acknowledged the same to be his free act and deed.

[Signature] Witness

Date May 3, 2001 Bengt J. Olsson L.S.  
Bengt J. Olsson (Signature)

On this 3 day of May, 2001, before me, a witness, personally appeared Bengt J. Olsson to me known and known to me to be the person of that name, who signed the foregoing instrument, and he acknowledged the same to be his free act and deed.

[Signature]  
Witness

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**DECLARATION FOR NON-PROVISIONAL PATENT APPLICATION\***

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below at 201 et seq. beneath my name.

I believe I am the original, first and sole inventor if only one name is listed at 201 below, or an original, first and joint inventor if plural names are listed at 201 et seq. below, of the subject matter which is claimed and for which a patent is sought on the invention entitled

**METHOD AND APPARATUS FOR PROVIDING ROUTING IN A CIRCUIT SWITCHED NETWORK**

and for which a patent application:

- ☐ is attached hereto and includes amendment(s) filed on *(if applicable)*  
☒ was filed in the United States on March 30, 2001 as Application No. TBA  
☒ was filed as PCT international Application No. PCT/SE99/01799 on October 7, 1999

I hereby state that I have reviewed and understand the contents of the above identified application, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119(a)-(d) of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

EARLIEST FOREIGN APPLICATION(S), IF ANY, FILED PRIOR TO THE FILING DATE OF THE APPLICATION			
APPLICATION NUMBER	COUNTRY	DATE OF FILING (day, month, year)	PRIORITY CLAIMED
9803418-4	Sweden	October 7, 1998	YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>
PCT/SE99/01799	PCT	October 7, 1999	YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>
			YES <input type="checkbox"/> NO <input type="checkbox"/>

I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States provisional application(s) listed below.

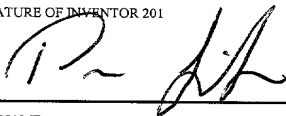

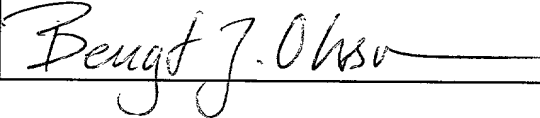
PROVISIONAL APPLICATION NUMBER	FILING DATE

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code §112, I acknowledge the duty to disclose information known to me which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

NON-PROVISIONAL APPLICATION SERIAL NO.	FILING DATE	STATUS		
		PATENTED	PENDING	ABANDONED

\* for use only when the application is assigned to a company, partnership or other organization.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

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	POST OFFICE ADDRESS	STREET Rådjursvägen 303	CITY Tumba	STATE OR COUNTRY Sweden	ZIP CODE SE-147 34
		SIGNATURE OF INVENTOR 203 		DATE May 3, 2001	